International Journal of Economy, Energy and Environment
2022; 7(6): 125-138
http://www.sciencepublishinggroup.com/j/ijeee
doi: 10.11648/j.ijeee.20220706.11
ISSN: 2575-5013 (Print); ISSN: 2575-5021 (Online)

The Effect of Wheat Crop Row Sowing on Income of Farmers, in Wayu Tuka Woreda East Wollaga Zone, Oromia Regional State, Ethiopia

Lelisa Mamo Abdisa

Faculty of Business and Social Sciences, Rift Valley University, Nekemte, Ethiopia

Email address:
lalimmamohu2001@gmail.com

To cite this article:
Lelisa Mamo Abdisa. The Effect of Wheat Crop Row Sowing on Income of Farmers, in Wayu Tuka Woreda East Wollaga Zone, Oromia Regional State, Ethiopia. *International Journal of Economy, Energy and Environment*. Vol. 7, No. 6, 2022, pp. 125-138.
doi: 10.11648/j.ijeee.20220706.11

Received: September 27, 2022; **Accepted**: November 8, 2022; **Published**: November 16, 2022

Abstract: The aspire of the study were to the effect of wheat crop row sowing on income of farmers, in Wayu Tuka Woreda East Wollaga Zone in Ethiopia. Wheat crop sowing is a highly valuable grain for Ethiopian people both in production and in consumption. The objective of the research was to describe the factors affecting adoption and intensity of wheat row sowing in the study area. The study was based on cross sectional research which was included both qualitative and quantitative research approach. The data were collected from total 135 respondents selected from three kebels of Wayu Tuka Woerda by using random sampling method. From the total 135 respondents 82 were wheat row sowing adopters while 53 were non wheat row sowing adopters. Both primary and secondary data used and analysed using descriptive statistics and logit model. The software used for data entry and analysis were STATA14.2. The results show that about 61% of the respondents are users of wheat row sowing whereas 39% can be classified as non-adopters of wheat row sowing. The empirical Results revealed that age, credit access and agricultural input use of household negatively influenced decision to adopt wheat row sowing while accesses to technology, total annual income, access to training and availability of labour force were positively influenced the decision to adopt wheat row sowing. Finally, wheat row sowing has significant impact on farmer's income increment. It is better to encourage farmer households as they actively participant in wheat row sowing technology and support them by giving training, supplying agricultural inputs and adopting new technology for them with adequate skills for enhancing their annual income and development of the country economy.

Keywords: Adoption of Wheat Row Sowing, Income of Farmers, Logit, Wayu Tuka Woreda

1. Introduction

1.1. Background of the Study

In 2013 alone, African countries spent over $12 billion to import more than 40 million metric tons of wheat, equate to about a third of the continent's food imports. Compared to broadcasting method, row sowing gives better yield. To minimize lodging, low seed rate, row sowing, late sowing and application of plant growth regulators were used Row sowing of wheat, rather than broadcasting method, improves production and productivity [1]. Agriculture leftovers the most important income source of many farm households in sub-Saharan Africa (SSA), productivity levels is stumpy and growth rates have recently idle [2]. Increased uptake of improved crop varieties, inorganic fertilizer, and irrigation is therefore promoted to farmers to achieve similar income benefits in SSA as observed during Asia's Green Revolution [3]. In a country of over 80 million people, wheat accounts for about 15% of all calories consumed in Ethiopia.

Furthermore, approximately 6 million farmers grow wheat and it is the dominant cereal crop in over 30 of the 83 high-potential agricultural [4]. Row sowing method has now become the latest farming technology aggressively promoted for adoption by smallholder farmers in Ethiopia [5]. Despite such interventions, adoption of row sowing technology in Ethiopia and specifically in the study Woreda is still low. Finally, the most impact evaluations do not collect detailed

data on the cost of production. This information gap damage understanding of the conditions under which the success of a new technology can be assessed [6]. We therefore collected data on farmers' inputs and wheat output to assess the broader impacts of adopting row sowing on wheat productivity and profitability at the farm level.

In a country of over 80 million people, wheat accounts for about 15% of all calories consumed in Ethiopia. Furthermore, approximately 6 million households grow wheat and it is the dominant cereal crop in over 30 of the 83 high-potential agricultural [7], however, production has been increasing at approximately 11%per year (due to land expansion and increase in income), with high latent demand resulting in price increases as well according to BoARD.

Nevertheless, the culture of recycling some potential sources broadcasting mated such as animal manure and crop residuals has been poor in Wayu Tuka Woreda. As such, this necessitated evaluation of factors contributing to low adoption of wheat row sowing and use intensity of non-adopters of wheat row plating of small holder farmers in Wayu Tuka Woreda of Ethiopia.

1.2. Statement of the Problem

[8] Sawing in line/row sowing of Wheat crop sowing was implemented with few early adopters in Oromia in order to increase crop productivity and yields for small scale farm farmer. More than 6 million farmers source of revenue depends on the production of Wheat crop cultivating covering the largest agricultural area of the country than any other types of grain, however, the amount of production is not as much as its area coverage and value [9].

Having these backgrounds of irrigation, some local studies were conducted to solve move violently associated with it. For instance, The study conducted by Behailu was examine determinants of the adoption of row sowing on Wheat crop sowing farmer's and yield improvement on the production of Wheat crop sowing]: the case of Minjara Wored [10]. The Impact of row sowing of Wheat crop on rural farmer income: A case of Tahtay Maychew Woreda, Tigray [11]. Determinants of adoption of Wheat crop sowing (Eragrostis) row sowing technology in Moretna Jiru Woreda, North Shoa Zone of Amhara Regional State [12]. Determinants And Intensity Of Adoption Of Wheat crop sowing in Minjar Shenkora Woreda,[13].

Wheat crop sowing is the major stable food crop to most of the Ethiopian people living in the highlands which comprise more than 65% of the population. However, the national average income Wheat crop sowing is very low, 1.4 ton per hectare and the development of high incoming cultivars would be very beneficial [14]. Wheat is a highly valuable grain for Ethiopian people both in production and in consumption. It is a staple food and a source for more than 15% of calories intake by the total population of the country.

1.3. Research Questions

The following research questions were prepared to answering the research gap:

1. What are the factors affecting farmers to adopt Wheat crop row sowing in the study area?

1.4. Objective of the Study

1.4.1. General Objective

This Research is to identify the effect of wheat crop row sowing on income of farmers, in Wayu Tuka Woreda East Wollaga Zone, Oromia Regional State, Ethiopia.

1.4.2. In Line with the Research Questions the Specific Objectives of the Study Are

To describe the factors affecting adoption and intensity of wheat row sowing in the Wayu Tuka Woreda

2. Theoretical Literature Review

2.1. Definition of Some Terms and Concepts

Crop Sowing with space' involves the growing of plants on a plot of land with sufficient space between each of the plants so that they can develop their roots and shoots more fully. As focused by ATA [15]. Crop 'sowing with space' starts with growing seedlings in a nursery and sowing these in the field with sufficient and equal spacing between each seedling.

[16] Investigated impacts of adoption of improved wheat technologies on household's food consumption in south eastern Ethiopia. As to ATT that calories per day percentage increase came on the adopters of wheat row sowing method wheat thereby increasing household's income. A study conducted by Tolesa in Arsi Zone of Ethiopia showed that the impact of wheat Row Sowing on income of Small farm household by applying the logit and propensity score matching. As to their study the variables like age of household, access to credit and livestock holding size and farm income in the high land Woreda and household size and farm income in the lowland Woreda are significantly influence row sowing of wheat respectively in Ethiopia, showed that the selected wheat seed, a lower seeding density, row sowing, fertilizer recommendations, and marketing assistance as full-package obtain higher wheat income as compared to non-users,[17].

An empirical study carried out by [18] showed that Effect of wheat row sowing technology adoption on small farms income in Ofla Woreda, Ethiopia by using propensity score matching method. As to their study Variables like sex, age, field visit days, and age square are significant on wheat row sowing technology adoption on a little. The result of their study showed that the marginal farm land adopter will get higher production than non adopter of wheat producer in a single production year. Those results are consistent to the researches that had been done before, [19].

However, as focused by Ray the adoption does not essentially follow the suggested stages from awareness to adoption; trial may not be at all times practiced by farmers to adopt new technology. Decision-making process is the process via which an individual passes from first knowledge

of an innovation, to forming an attitude toward an innovation, to a decision to adopt or reject, to achievement of new idea, and to confirmation of the decision [20].

2.2. Factors Affecting Technology Adoption

The purpose of wheat row sowing program is to increase farm production and productivity through creation of awareness and technology adoption. The factors documented in literature include farming farmer specific characteristics, available farm resources, access to credit, information and market.

2.3. Improved Technologies and Wheat Incomes

Africa, south Africa, and sub-Sahara has a tremendous scope and potential for increasing bread and durum (pasta) wheat row productivity, whilst likely worst affect by climate change e.g. shorten growing seasons, erratic rainfall, increases in day & night temperatures, new emerging diseases. Some of the highest spring wheat row sowing yields worldwide are obtained in African countries (Egypt, Ethiopia, Namibia, Zambia, Zimbabwe), but only by very few farmers.

Despite the importance of wheat in Ethiopia, in come are remarkably low. While in 2012 - 2013, wheat land productivity reached 1.4 ton per hectare, this is rather low when compared to other cereals such as maize (3.1 ton per hectare), rice (2.8 ton per ha) and wheat (2.1 ton per ha) [21]. Several factors explain these low incomes. First, modern input use in wheat production such as inorganic fertilizer and improved seed is low. Latest national estimates show that only two percent of wheat farmers used improved seeds, although more than one third applied fertilizer for wheat production [22]. Second, plant lodging, to which wheat is susceptible, is perceived to be detrimental for wheat grain production, especially during the grain-filling period. Third, land is continually ploughed prior sowing to prepare the seedbed and control weeds, but this leads to increased corrosion and lower soil fertility [23]. Fourth, soil corrosion has led to nutrient (mainly nitrogen and phosphorus) shortage in the drier areas of the country [24]. Generally, there are important post-harvest and processing losses [25].

Tolesa and et'al. Conduct a study on Impact of Wheat Row Sowing on farmer income in Selected Highland and Lowland Areas. Sowing wheat crop sowing in rows at low rate instead of scattering seeds by hand recommendations will be introduce to about 300,000 wheat farmers in locate in four main wheat belt regions of Ethiopia: Amhara, Oromia, SNNPR, and Tigray [26]. In Oromia Regions who plant wheat extension systems more efficient and effective; increasing wheat row sowing productivity among smallholders; establishing and strengthening the capacity of farmers.

2.4. Empirical Literature

The general trend saw farmers who planted later with relatively smaller yield increases compared to those who planted during the traditional season and earlier [27]. As to the study made by ATA in Oromia farmers who planted three weeks near the beginning experienced slightly higher average yield increases than during the traditional sowing period. In this three week period before the traditional sowing period farmers had 66% to 90% average yield increases in comparison to 67% to 72% increases through the traditional sowing time. Farmers who planted 4-5 weeks early experienced lowest average yield increases, 20% to 51%, which were even lower than those farmers who planted in late August and September.

In SNNP and Oromia early sowing income increases were especially irregular, sometimes negative, and sometimes extremely high. The income effects of early sowing should be studied with the relatively small sample size. Less than 10% of the validated farmers planted before the traditional sowing period, and some of the income increases are likely affected by trans sowing. Furthermore sowing times are geographically specific, depending on rainfall patterns and thus data collected across a wide geographic area may be misleading [28].

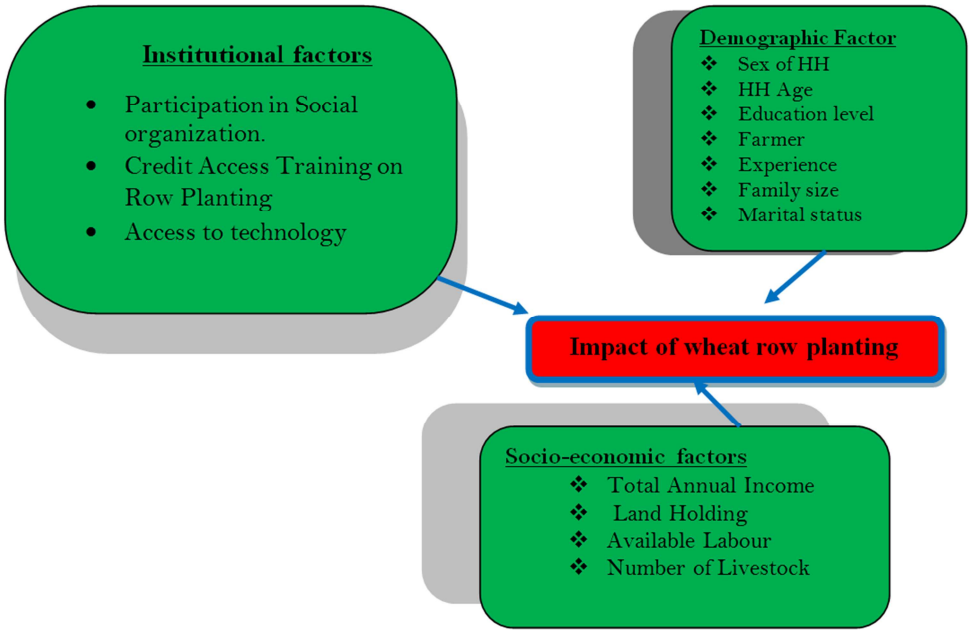
However, under appropriate cultural practices, improved varieties can income up to 3.4 tons/ha on farmers' fields, 4 indicating that there is an ample opportunity to increase wheat productivity with high yielding varieties and improved management practices. Wheat is not only a fundamental ingredient in Ethiopian diets, but also an integral part of the national culture [29]. Unfortunately, without the benefit of worldwide focus, wheat remains what is often called an orphan crop; one that has received significantly less international research on breeding, agronomy, mechanization, and processing. The adoption of more resourceful farming practices and technologies that improve agricultural productivity and improve environmental sustainability is instrumental for achieving economic growth, food security and poverty lessening in Oromia, Ethiopia. Tolesa [30] conducted study Socio-economic and Institutional Factors Limiting Adoption of Wheat Row Sowing in Ethiopia, by applying logit model.

2.5. Conceptual Framework

The determinant of degree and direction and degree of astonish of adoption are not uniform; the impact varies depending on type of technology and the conditions of areas where the technology is to be introduced [31]. As to their study Variables like sex, age, field visit days, and age square are significant on wheat row sowing technology adoption on small farmers. The result of their study showed that the marginal farmland adopter was gotten higher production than non- adopter of wheat producer in a single production year. Those results are consistent to the researches that had been done before [32].

In this study efforts will be made to figure out the impact of sowing in line of wheat according to farmers' personal characteristics, accessibilities to different services such as credit, extension, and Psychological factors. Furthermore literature, practical experiences and field observations have established that technology adoption by farmers' can be

enhanced in a sustainable manner by understanding those factors influencing the pattern, extent and direction of adoption and plans through farmers empowering, increasing farmers access to infrastructure, information, credit field support, etc and acquainting them how to make use of the technology. Farmers' contribution in technology expansion, and dissemination strategies as well as result evaluation should be considered, because farmers have long years of farming experience and social contact with ecological conditions.



Source: Researcher own Design (2022)

Figure 1. *Conceptual frame work on adoption of row sowing.*

3. Research Methodology

3.1. Description of the Study Area

3.1.1. Geographical Location of the Study Area

This study was conduct on Wayu Tuka Woreda of East Wollega Zone, Oromia Regional State, Ethiopia Administration. It located about at 331 kms far from the capital city of the country Addis Ababa. The Woreda has total land area of 40,539.36 hak. majority of the peoples in this Woreda are mainly depends on the agriculture activity. Wayu Tuka Woreda is bounded by four Woreda on four direction at North Sibu sire and Guto Gida Woreda, South Wama Hagalo and, Nunu Kumba and Leka Dulacha Woreda, East Sibu Sire Woreda and West Guto Gida and Leka Dulacha Woreda. Geographically it is situated at longitude and latitude 90.05`N degree 36.30`E degree with an elevation of 1960 and 2170 matters above sea levels and the located East part of Oromia [33].

Wayu Tuka woreda total land size is current 40,539.36 ht. From this land size households can cultivate 14,536.5 (36%) ht land size. The ecological zone of Wayu Tuka Woreda is categorized into three parts. Those are highland (Dega), midland (Woiyna Dega) and lowland (Kola) 37.66%, 49.23% and 13.11% respectively with the mean annual rainfall range from 110- 2400 mm averagely 1600 per years. The area receives rainfalls that are long rainy season June up to September and short rainy season March- May. The Woreda has all soil types that are essential for agricultural activities [34].

3.1.2. Demographic Characteristics of the Study Area

As Wayu Tuka Health Administration Office report of 2020 total population of the Woreda whose 89508 from these 43859 (49%) who are male and 45649 (51%) who are females. In Wayu Tuka Woreda different religions groups followers are exists. Majority of the peoples are followers Protestant religion 25960 (33%) followers and 27986 (36%) are Orthodox flowers, 21084 (27%) are Muslim and the rest (4%) are catholic and traditional believers like what we called "kalu" followers. All most all of the Woreda are talk Afan Oromo, Tigre language while some are talk Amharic and Afan Oromo language. So, Tigre language talkers are few in number when we compares with other language spoken in that Woreda. The life of most people in the area is dependent on agricultural practicing and mixed farming; crop production and livestock are the major income activities practiced as means of income.

3.2. Research Design

The particular of a research can be exploratory, descriptive casual/explanatory Casual research design was adopted as the optimal and most effective design approach to investigate the possible "cause-and impact" issues. As to the design of causal research design [35], the researcher tries to separate the "cause" (independent variables) and examine whether it has any effects on dependent variable wheat row sowing

adoption. According to IDRC [36], this type of research design is use in descriptive research design and in determination of relationship of variables. This research design was use because of the limited time and finance in field work and the fact that it was deemed to be adequate for addressing the study objectives,[37].

3.3. Type of Data Source and Collection Techniques

3.3.1. Data Type

The qualitative and quantitative types of data were used in the study under investigation. The quantitative part of research relies on data collected using structured questionnaire that include questions on issues of determinant of organic fertilizer factors that affect income of smallholder farmers of survey respondents. On the other hand, qualitative part of the research focuses on investigating the perception of interviewee on factors that influence the fertility of smallholder farmers. Information was attained through interviews and focus group discussions which are guided by semi-structured questions.

3.3.2. The Source of Data

The study was employed by using both primary and secondary data sources. The Primary data sources were randomly selected households, Regional, zones and Woreda Agricultural and Natural Resource Offices, community organizations, non-governmental organizations development agents (DA), government officials and professional experts. Furthermore, Secondary sources include policies documents, Sartorial reports at different layers of the government, Central Statistical Authority (CSA), books, journal articles, working papers and internet browsing were used to back up the result from primary sources of data.

3.3.3. Methods of Data Collection

Both quantitative and qualitative data from primary and secondary data sources were collected for this study. The primary data was collected using structured and semi-structured questionnaire, interview and focus group discussions. In addition, Secondary data was collected to supplement the primary data.

Structured questionnaire were administered to 135 sampled households. Enumerators who have experience in socio-economic survey were employed after training on basic interview techniques and survey questionnaire administration. Sampled households are asked to answer a series of questions included in the survey questionnaire. The survey questionnaires are prepared to bring out information on a variety of topics including resource endowment of households, access to markets, agricultural and extension services, Perception about the soil fertility and Access to information of the household respondents.

In addition to official survey, data were collected via focus group discussions. Moreover, interviews guided by semi-structured questionnaires were held with development agents, key informants, experts and officials who work in close collaboration with the households in the study area. This information is valuable in providing insights into perceptions of different actors and also it will supplement some information that was not captured by the questionnaire and to cross-check the reliability of the reaction from the household survey.

3.4. Sampling Procedure

They are 17 Woreda that found in east Wollega zone in Wayu Tuka is one among this Woreda. To select sample respondents from that Woreda has three stage stratified sampling technique was employee. In the first stage, Wayu Tuka Woreda was purposely in this selected. The fact that this woreda was appropriate because; wheat row sowing of wheat is practice widely and wheat coverage from total cultivates land in the Woreda is better than other. In the second stage, using purpose full sampling technique three kebeles. Those are:- Magna Kura, Gara Abalo and Boneya Molo kebeles was selected from 12 kebele based on their practice of row sowing better than others and 135 farmers was select as sample size. Hence these kebele have both households practicing the wheat row sowing and those do not practice row sowing.

At last the household heads list will identified followed by a systematic random sampling technique to select sample households from each kebele, those households who adopt row sowing technology and those farmers who practice the traditional farming system. Then the sample respondent from each stratum was been select randomly using simple random sampling technique [38].

3.5. Sample Size Determination

As to Dawson,[39] the correct sample size in a study is based on the nature of the population and the function of the study. This research was conduct with five percent precision, 95 percent confidence interval and 0.5 population variance. Then the following formula was used for the calculation of the sample size since it is relevant to this study and sampling method [40] provides a simplify formula to calculate sample sizes.

$$n = \frac{\frac{P(1-P)}{\frac{A^2}{Z^2}+\frac{P(1-P)}{N}}}{R}$$ Where; n=sample size; N=Number of population (1750);

P=Estimate of variance in a population as a decimal of 0.1 for 90-10;

A=precision level, expressed as decimal of 0.05;

Z=Confidence level of 1.96 for 95 percent;

R=Response rate, as decimal of 0.95.

$$n=\frac{\left(\frac{0.1(1-0.1)}{\frac{(0.05)^2}{(1.96)^2}+\frac{0.1(1-0.1)}{1750}}\right)}{0.95}=\frac{\left(\frac{0.09}{\frac{0.0025}{3.8416}+\frac{0.09}{1750}}\right)}{0.95}=\frac{\left(\frac{0.09}{0.0006507705+0.000051428}\right)}{0.95}=\frac{\left(\frac{0.09}{0.0007021985}\right)}{0.95}=\frac{(128.1688)}{0.95}=134.91=135$$

Table 1. *The Number of Sample Respondents in Each Kebele.*

No.	Kebeles	Household heads			Sample taken		
		Adopter	Non-Adopters	Total	Adopter	Non-Adopters	Total
1	Magna Kura	370	300	670	28	24	52
2	Gara Abalo	520	310	830	40	24	64
3	Boneya Molo	130	120	250	14	5	19
	Total	1020	330	1750	82	53	135

Source: Wayu Tuka Woreda Agriculture Office (2022).

3.6. Method of Data Analysis

The main objective of the study is to analyze effect of wheat row sowing on farmer incomes. To achieve these objective two types of data analysis, namely descriptive and econometric models were used for analyzing the data collected from households and other sources in relation to the study.

3.7. Descriptive Analysis

Descriptive statistics such as frequencies distribution, mean, standard deviation, and percentages were used to have a clear picture to analysis the data. Chi-square test and t-tests were also used to compare adopters and non-adopters in terms of explanatory variables.

3.8. Econometrics Model Specification

Model Specification applies linear regression model the analysis of this study on the existing literature review that identification of the impact of wheat row sowing on farmer incomes. The study was affected by the independent variables such as demographic factors, social factors, Economic factors, sources of income factors, household education. This all factors of independent variables affect dependent variables like household income /incomes. Even it used as method of analysis to evaluate and cancel the inefficient policy technology.

According to Rubin, [41] the standard framework in evaluation analysis to formalize this problem is the potential outcome approach. [42] and [43] when leaving the binary treatment case the choice of multinomial logit is quite easier to analyze dichotomous variables and approaches relatively preferable mathematical performance to estimate. In the cause of binary treatment the adopter indication Di equals 1 and 0 otherwise.

A logit model would be used to estimate propensity scores using a composite of pre-intervention characteristics of the sample households [44] and matching was then performed using propensity scores of each observation. In estimating the logit model, the dependent variable was wheat row sowing technology adopter, which took the value of 1 if a household non-adopter in wheat row sowing 0. The expression of the logit model was: It computed by using the linear probability model of:

$$P(y=1/xi)=\text{Zi}=\beta_0+\beta_1x_1+\beta_2x_2+\cdots+\beta_kx_k \ldots \quad (1)$$

$$\text{Pi}=\frac{1}{1+e^{-zi}} \text{ is simplified to: } \text{Pi}=\frac{e^{zi}}{1+e^{zi}} \quad (2)$$

Where, Pi is the probability that the i^{th} households was adopters of wheat row sowing, z_i -is a linear function of 'n' explanatory variables (x) and it was expressed as follows:

$$\text{Zi}=\beta_0+\beta_1x_1+\beta_2x_2+\cdots+\beta_kx_k+\cdots U_i \ldots \quad (3)$$

Where, β_0 -intercept, βi - regression coefficients to estimate, U_i– is an error term.

$1-\text{Pi}=\frac{1}{1+e^{-zi}}$ is simplified to:

$$1-\text{Pi}=\frac{1}{1+e^{zi}} \quad (4)$$

Where 1 – Pi is the probability that a household belongs to the non-adopters.

$$\frac{\text{Pi}}{1-\text{Pi}}=\left(\frac{1+e^{zi}}{1+e^{-zi}}\right)=e^{zi}$$

or

$$\left(\frac{\text{Pi}}{1-\text{Pi}}\right)=\left(\frac{e^{zi}}{1+e^{-zi}}\right)=e^{(\beta_0+\beta_1x_1+\beta_2x_2+\cdots+\beta_kx_k)} \quad (5)$$

This is known as Odds ratio. By taking the natural logarithm of odds ratio, the logit model is:

$$\text{Li}=\ln\left[\frac{\text{Pi}}{1-\text{Pi}}\right]=\ln e^{(\beta_0+\beta_1x_1+\beta_2x_2+\cdots+\beta_kx_k)}=\beta_0+\beta_1x_1+\beta_2x_2+\cdots+\beta_kx_k \quad (6)$$

Where x_1, x_2, --------, x_k are demographic, social and Economic factors that cause impact of wheat row sowing which was been included in the above econometric model.

4. Results and Discussion

Introduction

In this chapter, data was presented and discussed regarding Impact of wheat row sowing on farmer incomes. Findings gained from descriptive and econometric analyses are presented and discussed. The econometric analysis was used to identify and analyze impact of wheat row sowing on farmer incomes using logit model. This model was used to identify factor-affecting income of farmers via OLS. The dependent variable is impact of wheat row sowing which is dummy variable (1=adopter 0= non-adopters). Before discussing the econometric results, some descriptive statistics were presented.

4.1. Descriptive Analysis of Sample Households' Characteristics

Sex of household's head: From total sample (135), 101 (74.81%) are males and 34 (25.19%) households are female headed. These all discussion is showmen in the table 2 below frequency and percentage of sex group taken as respondents. The result exposed that more male-headed households participate in row sowing than female-headed ones. However, the chi-square (χ^2) statistics obtained from mean comparison test indicates that there was no significant difference between male and female on participation in row sowing program.

Table 2. *Distribution of households by sex using frequencies.*

Sex	Freq.	Percent	Cum.
Females	34	25.19	25.19
Males	101	74.81	100.00
Total	135	100.00	

Source: Own computation from households survey data (2022)

The study found that of the total (82) participants 61 (74.39%) are males while the rest 21 (25.61%) are females. Similarly 40 (75.47%) of the non-participants are males while 13 (24.53%) are females.

Table 3. *Household participation distribution by Sex in row sowing program.*

Sex	Adaptors		Non-Adaptors		Total	
	No	%	No	%	No	%
Male	61	74.39	40	75.47	101	74.8
Female	21	25.61	13	24.53	34	25.2
Total	82	100	53	100	135	100

Source: Own computation from Survey data (2022)

Educational Status of household's Head: The result shows that almost near to half of sampled households 66 (48.89%) were not attended either formal or informal school or illiterate whereas 69 (51.11%) were educated. From the total male-headed households, 50 respondents (49.50%) are literates while the remaining 51 (50.50%) are illiterates meaning that they cannot, at least, read and write. Of the total female headed households, 19 respondents (55.88%) are literates while the remaining 15 (44.12%) are illiterates.

Table 4. *Educational status of sampled household respondents.*

Education	Freq.	Percent	Cum.	Sex of Respondents			
				Males		Females	
				No	%	No	%
Illiterate	66	48.89	48.89	51	50.50	15	44.12
Literate	69	51.11	100.00	50	49.50	19	55.88
Total	135	100.00		101	1000	34	1000

Source: Own computation from households survey data (2022)

Age of sampled household heads: The average age of the farmers, heads are 45 years with a range of 19 to 51 years. The age structures of the surveyed farmers heads reveal that 35.56% of the household heads (48) are above the age of 51 years (they are economically inactive), whereas the remaining 64.44% farmers heads (87) are on the age range of 19 to 50 years (most probably they are economically active).

Table 5. *Age group of the household head.*

Age groups household heads	No	Percent
19-50	87	64.44
>51	48	35.56
Total	135	100

Source: Own computation from households survey data (2022)

4.2. Households' Socio-Economic Characteristics

Household Land size Holing: The average mean of land holding of the surveyed households equal to 10.2 ha with a minimum of 1 ha and a maximum of 30 ha. This figure is larger than the average countrywide figure, which is 1.2ha [45] representing the subsistence of relatively higher land holdings in the study area. Although this number is over than the nationalized average, there exists a high gap among farmers based on their farmland holdings. The average mean of land size for program participants and non-participants were 10.11 and 10.17 respectively with the mean difference of 0.056. This implies that mass of adopter participant farmers had small land size. However, they were economically active age groups while host households or non-program participant farmers had large land size. Land size here consists of both cultivable and non-cultivable lands owned by the household farmers. The most important source of labour for crop production in the study area is family labour due to they have surplus productive force as the author was observed the study area. The average labour force size of the surveyed farm households equals to 8.15.

Table 6. *Access to technology of the household head and Adopters-non adopters of row sowing of households.*

	Freq.	Percent	Cum.
Technology			
Not access to technology	83	61.48	61.48
Access to technology	52	38.52	100
Total	135	100.00	
Iwrpt			
Not row sowing Adopters	53	39.26	39.26
Row sowing adopter	82	60.74	100.00
Total	135	100.00	

Source: Own computation from households survey data (2022)

Access to Technology input (acctt): From the total respondents of 52 (38.52%) were access to technology while 83 (61.48%) were not access technology inputs. From the total sampled households 53 (39.26%) in the non-adopters and from the total sampled households 82 (60.74%) are adopters. The mean difference between those gained technology inputs in the non-adopters and adopters were -0.54. Generally, the null hypothesis' was significant, due to our variable, access to technology input was more important in our study, however more of the households heads were not want to adopt of row sowing technology.

4.3. Institutional Factors

Credit access to Wheat row sowing: Credit access is an important source of finance in agricultural technology adoption. It was found that about from the total 135 farm households 53 (39.26%) households did not have access to credit and while the remaining 82 (60.74%) households has access to credit.

Extension contact agency: Extension service refers to demonstrations advice delivered to the farmers mainly by development agents and other agricultural experts. It was measured in terms of the frequency of farmers whether they meeting or not with extension workers during the previous agricultural season. In comparison, it was found that the extension contact was about 60.74 percent among the adopters of while that of non-adopters was about 39.26 percent. The difference in the average extension contacts between the adopters and non-adopters of wheat row sowing was insignificant. The result shown that the adopters of wheat row sowing had better access to extension services on average compared to non-adopters justifying that the higher contact of extension service may have contributed toward adoption of wheat row sowing. [46] argued that farmers who have regular contact with agricultural experts are more likely to adopt agricultural technologies. Similarly,[47] claimed that the frequency of extension visits increased the possibility of commercial wheat row sowing in adoption in Nigeria.

Table 7. *Institutional factors that affect row sowing technology.*

Variables	Adopter		Non Adopter		Total	
	No	%	No	%	No	%
Credit Access	82	60.74	53	39.26	135	100
Access to training	95	70.37	40	29.63	135	100
Extension contact Agency	82	60.74	53	39.26	135	100

Source: Own computation from households survey data (2022)

Training for farmer: During the improving agricultural technology, use of training was very important. The results indicated that the 29.63 percent were not taking training, whereas 70.37% took training (Table 6). In comparison, it was found that the household withheld training was not training about 28.30 percent among the non-adopters; while that of was about 71.70 percent it was found that the household withheld was training and about 30.49 percent among the adopters of wheat row sowing did not of training while the adopters was about 69.50 percent have training. The difference in the having training between the adopters and non-adopters of wheat row sowing was significant at 10 percent probability level According to [48] and [49] training affect use of wheat row sowing adoption.

4.4. Econometric Analysis of Factors Influencing Adopter and Non -Adapter Wheat Row Sowing

In this particular study, to analyze impact of wheat row sowing on farmers income in Wayu Tuka. For adapter logit model the researcher had been used fourteen demographic, socio economic and institutional factors. These factors are gender of household head, age of household head, education level of household head in years, household's family size, farm size in hectare, access to agricultural inputs, credit access, access to extension services, distance from market in walk hours or kilometers), livestock owned in TLU, farm income in Birr and household head's total asset in Birr were interpreted and analyzed with the help of stata soft ware. The section of the abovementioned variables was based on literature, data availability and prior knowledge of the study area by the researcher.

4.5. Hypothesis Testing

During regression models it was assumed that perfect co linearity does not exist among the explanatory variables. Multi co linearity indicates existence of exact linear relationship among the explanatory variables. In this study, using variance inflation factor (VIF), the average VIF was found to be 1.30 which was less than 10 showing that multicollinearity was not a serious problem among the continuous explanatory variables. Availability of heteroscedasticity was tested using Breusch-Pagantest (Cook-Weisberg test for heteroskedasticity). On the test result, probability greater than was given by 0.0000 implying that the model had no problem of heteroscedasticity. Finally, using Ramsey regression specification-error test for omitted variables (ovtest), the survey results revealed that the model had no problem of omitted variables. Therefore, it was concluded that the model was the most robust and complete.

Table 8. *Variance Inflation Factor for continuous explanatory variables.*

Variable	VIF	1/VIF
Avlf	2.01	0.497618
Agehh	1.95	0.513039
Toanin	1.04	0.962547
Dismark	1.04	0.963290
Nltlu	1.03	0.968086
Lands	1.03	0.968691
Farmexp	1.01	0.990085
Mean VIF	1.30	

Source: Own computation from households survey data 2022

In the same way, the Contingency Coefficient results showed absence of strong association between different hypothesized discrete explanatory variables (dummy variables), since the respective coefficients were very low (less than 0.75). As a result, the discrete variables were included in the model. The value of contingency coefficient (CC) is a chi-square based measure of association where a value of 0.75 and above shows the existence of strong multicollinearity problem.

Table 9. *Contingency Coefficient for dummy variables.*

Variables	Iwrpt	Sex	Credacc	Acctrain	Acipsu	Acctt	Educ	Excoag
Iwrpt	1.0000							
Sex	-0.0122	1.0000						
Credacc	-0.4910	0.1626	1.0000					
Acctrain	-0.0234	0.1467	0.1427	1.0000				
Acipsu	-0.2623	-0.0384	-0.0129	0.1864	1.0000			
Acctt	0.5428	-0.0317	-0.4235	-0.1531	-0.1555	1.0000		
Educ	0.5186	-0.0554	-0.4221	-0.1478	-0.0738	0.7437	1.0000	
Excoag	-0.1493	0.1276	0.0992	-0.0234	0.2053	-0.0494	-0.0883	1.0000

Source: Own computation from households survey data 2022

4.6. Results of Logit Model for Wheat Row Sowing on Farmer Income Decision of the Sample Households

As already mentioned, this study employed the logit model to estimate and conclude the parameters of the impact of farmers' wheat row sowing on farmer income decision in the study area. The results of the maximum likelihood estimation of the logit model showed that from fourteen variables such as: education status of household heads', farm land size in hectare, access to agricultural input, access of extension service credit access, farm income, total annual income of household head in birr and total livestock holding in tropical livestock unit had significant effect on the probability of smallholder farmers' wheat row sowing on farmer income decision.

On the other hand, gender, distance from market in kilometers, available family size of household heads, age of household, and non-farm income were turned out to be insignificant at less or equal to 10 percent significance levels.

The frequency distribution of wheat row sowing on farmer income reveals that out of the 135 total sampled households, 82 households (60.74%) were adopter while the remaining 53 (39.26%) were non-adopter of wheat row sowing. Thus, the result reveals that more than half of the sampled respondents were adopter of wheat row sowing.

Table 10. *Estimates of Maximum-likelihood logit model on the wheat row sowing on farmer income.*

Iwrpt	Coef.	Std. Err.	Z	P>z	[95% Conf.	Interval]
Sex	-.7596307	.7633734	-1.00	0.320	-2.255815	.7365537
Credacc	-2.103926	.7022833	-3.00	0.003***	-3.480376	-.7274762
Acctrain	1.466324	.7179926	2.04	0.041**	.0590842	2.873563
Acipsu	-1.512096	.6661959	-2.27	0.023**	-2.817816	-.2063764
Acctt	2.049395	.9668832	2.12	0.034**	.1543382	3.944451
Avlf	.3989114	.1617904	2.47	0.014**	.081808	.7160149
Agehh	-.0680422	.0381371	-1.78	0.074*	-.1427895	.0067052
Dismark	-.0025526	.0389435	-0.07	0.948	-.0788804	.0737752
Nltlu	.0819678	.0730407	1.12	0.262	-.0611893	.2251248
Lands	.0056612	.0456889	0.12	0.901	-.0838873	.0952097
Farmexp	-.0752845	.0977295	-0.77	0.441	-.2668307	.1162618
Toanin	.0000154	6.87e-06	2.24	0.025**	1.93e-06	.0000289
Educ	.9540028	.7826924	1.22	0.223	-.5800461	2.488052
Excoag	-.0643324	.6125004	-0.11	0.916	-1.264811	1.136146
_cons	-.3068206	2.037795	-0.15	0.880	-4.300826	3.687184
Number of Obs. =135						
LR chi2 (14) = 87.53			Log likelihood = -90.435645			
Prob > chi2 = 0.0000			Mean of dependent Var. = 0.607			
Pseudo R2 = 0.4839			SD of dependent Var. = 0.490			

Source: Own computation from survey data using stata14.2 (2022)
***, ** and * shows significance at 1%, 5% and 10% significance levels, respectively.

Out of the total 14 explanatory variables, 7 variables were dummy variables while 7 variables continuous variables. 7 (Seven) variables were found to be significantly creating variation on the probability of farmers' wheat row sowing.

Whereas, access to input supply, age of household in years, access to credit of household, access to training, availability of lobar force, access to technology and total annual income were significantly affecting wheat row sowing of farmers.

Table 11. *Estimation of Marginal effects after logit regression.*

Marginal effects after logit
y= Pr (iwrpt) (predict)= .7437514

Variable	dy/dx	Std. Err.	Z	P>z	[95%	C. I.]	X
sex*	-.1310717	.11641	-1.13	0.260	-.359232	.097088	.748148
credacc*	-.3528077	.10676	-3.30	0.001	-.562052	-.143564	.607407
acctrain*	.3091537	.15692	1.97	0.049	.001595	.616713	.703704
acipsu*	-.2618093	.10682	-2.45	0.014	-.471174	-.052445	.614815
acctt*	.3423665	.12833	2.67	0.008	.090844	.593889	.385185
Avlf	.0760266	.03016	2.52	0.012	.016922	.135131	8.14815
Agehh	-.0129678	.00725	-1.79	0.074	-.027182	.001246	45.5185
Dismark	-.0004865	.00743	-0.07	0.948	-.015044	.014071	16.5778
Nltlu	.0156218	.01398	1.12	0.264	-.011774	.043017	8.71111
Lands	.0010789	.00871	0.12	0.901	-.015992	.01815	10.1378
Farmexp	-.0143481	.01863	-0.77	0.441	-.050857	.022161	8
Toanin	2.94e-06	.00000	2.23	0.026	3.5e-07	5.5e-06	103775
educ*	.1816957	.15099	1.20	0.229	-.114248	.47764	.511111
excoag*	-.0122192	.11601	-0.11	0.916	-.239594	.215156	.607407

(*) dy/dx is for discrete alter of dummy variable from 0 to 1
Source: Own computation from survey data using stata14.2 (2022)

4.7. Interpretation of Significant Variables

Access to technology (acctt): The coefficient on the access to technology is significant at 5% level of significance with positive sign. It puts forward that a farmer who is facing challenges coming from technology is more likely to impact of the wheat row sowing on farmer income as compared to those who are not facing technology. The result indicates that being exposed to access to technology increase the likelihood of household in the adopters of row sowing by 34.24% than households exposed to access to technology it is agreed [50].

Total annual income (toanin): total annual income influences the farm households' impact of the of wheat row sowing on farmer income is positively associated with household total annual income and statistically significant at 5% of probability level and Household's total annual income was found to have a positive effect on the households' impact of the of wheat row sowing on farmer income. Total annual income owned by sampled household obtained from different annual income or capital sources such as: [human, social, financial, physical and natural] capitals. The FGD conducted there showed that human capital was one of the household incomes. Some seasonal diseases affect the household's income in study area., while natural capital like land resource was the abundant income for each sampled households in the study site as the researcher discussed with respondents. This variable is statistically important at 5% level of significance. The marginal effect results showed that a one Birr increase in total annual income of household heads from the $2.94x10^{-6}$percent increases the likelihood of the adapters of wheat row sowing whereas other factors remaining constant.

Age house hold (agehh): Age of the household negatively influenced adoption of wheat row sowing this variable was statistically significant at 10%. An increase in age by one year decreases the probability of adoption of wheat row sowing by 0.13%. Perhaps this is because older farmers tend to invest several years in a particular practice hence may not want to risk themselves by trying out completely other methods of farming [51]. Young household heads are more interested in trying out new agricultural technologies because of their risk taking character than old household heads that are risk averse. However,[52] indicated a positive relationship between age of the household head and adoption and use intensity of improved yam seed technology. In addition, [53] argued that as farmers get older they tend to intensify adoption of new agricultural technologies in their farming business as a result of more years of farming experience.

Credit access (craa): Farmers who have credit access are fewer participants in wheat row sowing technology. This is mainly because of the fact that even if their farm production is affected due to different factors they can start a business without participating in the agricultural production. Therefore, access to credit influences the farm households' participation in wheat row sowing negatively. The study result also reveals that credit access is statistically significant at 1% level of significance and a change from no credit access to access decreases the probability of the decision to join wheat row sowing other things remain constant, households those had access to credit has35.28%less probability to participate in the programme than their counterpart. It is supported by Muez [54].

Access to agricultural input supply (agrinp): Farmers who have access to agricultural input can increase their income rather than those who have no access agricultural inputs. So this implies that decrease the participation in wheat row sowing as compared to those who do not have access. Those who have access to agricultural input have the chance of producing more output. Therefore; access to agricultural input influences the farm households' probability of participation in wheat row sowing negatively. The study result also reveals that access to agricultural input is statistically significant at 5% level of significance and a change from no access to access agricultural input decreases the probability of the decision to join the program by 26.18% higher than their counterparts, holding other variables constant.

Access to training (extns): Access to training service influences the farm households' participation in wheat row sowing is positively associated with household total income and statistically significant at 5% of probability level. This may point out that in the study area, these households who get scientific advice, training or those who participated on field expression are well aware of the benefit of agricultural knowledge and willing to generate more production, in this manner improving the household total annual income. This result was decided with Adugna, [55]. The marginal effect of the variable indicates that household access to training service of the discrete effect change from 0 to 1 in access to training service decrease the probability of participation in wheat row sowing adoption by 30.92 percentage points than their counterparts others remain constant other factors.

Availability of labor force (avlf): Availability of labour force is influences the farm households' participation in wheat row sowing is positively associated with household total income and statistically significant at 5% of probability level. This may indicate that in the study area, those households who have labour force availability can actively involved in wheat row sowing and had the capability to generate more production, in this approach getting better the household yearly income. The marginal effect of the variable indicates that household had availability of labour force of the increases by one unit it increases the probability of participation in wheat row sowing by 7.6 percentage points than their counterparts while others factors constant.

4.8. The Major Challenge Impact of Wheat Row Sowing in the Study Area

Different challenges were faced to adapters and non-adapters during impact of wheat row sowing. Lack of train, lack extension contact. As the researcher was undertook FGD with the sampled household heads they were raised more ideas regarding to challenges problems faced to them. Especially those adapters households were talk different factors that challenged them to involve in the impact wheat row sowing. Those factors are distance from market, agehh, family size mean that over populated and joblessness while non adapters were talked problems like shortage of land distance from market due to it shared for adapters household and other social resources which is common for all societies impact of wheat row on framer income. Adapters applied in Wayu Tuka Woreda one of the impact of wheat row on framer income under taken by the Government support. The result of this study was exposed that adapters more beneficial than their non-adopters due to enhance their income and other facilities in the study area.

5. Summery, Conclusion and Recommendation

5.1. Conclusions

This study has investigated powerful factors which determine the probability of wheat row sowing adopters and non-adopters wheat row sowing in Wayu TukaWoreda, Oromia region, Ethiopia. A cross sectional at with a sample of 135 has been famers in the analysis. Today, there is a general consensus that wheat row sowing production is considered as one of the most important inputs for the achievement of increased agricultural production and productivity in the Ethiopia, which is one of Sub Saharan Africa countries. The result of the study has shown that the constraints use of wheat row sowing technology to age households, distance from market and inadequate labour.

An increase in the household age discouraged adoption wheat row sowing showing that Young household heads are more interested in trying out new agricultural technologies because of their risk taking nature than mature household heads who are risk unwilling. empirical estimate of the first hurdle of this study revealed that access technology, total annual income, numbers turning and access to technology are positive relate to likelihood of adopting wheat row sowing. The positive effect of training might be due to increase in possibility of meeting with other farmers to be informed about the new technology and that of income might be because of that a household whose income depends on farm activities does not have enough turning to use adapters of wheat row plating. The study found out that more experienced farmers seem to no- have better information and knowledge accumulated over time. This result is reasonable because farming experience improves farmer's behavior of coping up with problems of non wheat row sowing (broadcasting) and reduces likelihood of non-wheat row sowing adoption (broadcasting) and lower the use of broadcasting could possibly result in more use of adapters of wheat row plating. It was also found that lands positive effect on adoption decision of on the other hand, estimates of the second hurdle revealed that, the extent of use of wheat row sowing was determined positively by farm size and lack livestock and negatively by arm income an application frequency.

Further, households who had adopted wheat row sowing earned better average per hectare farm income compared to the non-adopters. This implies that the adoption of wheat row sowing positive impact on households' farm income in the study area therefore farmers should be encouraged to use wheat row sowing Generally speaking, this study has concluded access to wheat row sowing has a profound impact on improving the yield output of household farmers in the study area.

5.2. Recommendation and Policy Implications

This study has the following useful for policy implication and future researchers in the area study area factors affecting the adoption wheat row sowing on farmer income in Wayu Tuka Woreda in particular and Ethiopian in general. The study drew attention to information that can guide policy towards influencing adoption Wheat row sowing and non-Adopter wheat row sowing which can have a potential benefit, increased productivity and environmental sustainability. Therefore, the policy implication of this study is as it is better to encourage row sowing technology adoption because the

results of this study signify that application of wheat row sowing technology; enlarge considerably both the yield and income of adopters. On the other hand, the number of adopters and the cropped area under wheat row sowing is significantly low to show larger impact on the overall increase of production. Depending on the finding the following recommendations were given by researcher:

1) Technology is positively relation with wheat row sowing and producing large output. It puts forward that a farmer who is facing challenges coming from technology is more likely to impact of the wheat row sowing on farmer income. It is better to encourage farmers as they actively adapt technology for enhancing their income and government should facilitate the condition for these farmers side to side.
2) It is better if the farmers trained on wheat row sowing techniques. Government should be assigned DA's for farmers' trainee as they increase their knowledge regarding to understand the utilization of all modern agricultural inputs such as improved seed varieties, commercial of fertilizer and different chemicals through training.
3) The detail is that the farmers could not have adequate money to buy all the essential agricultural inputs on cash and be short of habit to use short-term credit from financial institutions in the last cropping seasons. So, it is required for the national and regional strategy makers to assess and find out customs in which farmers to get the tradition of use credit facility for acquire of agricultural inputs in order to produce surplus product for food achievement.
4) Most of farmers household head were depending on agricultural production or obtaining their income from faming activities rather than non-farm income due to low diversification of non -farm activity during comparison with farm income in study area. Total annual income is significant and positively related to Wheat row sowing. So it is better if local or regional government giving more attention to improve wheat row sowing for rural households as they increase their annual income.
5) Farmers who have access to agricultural input supply can increase their income rather than those who have no access to agricultural supply inputs. Therefore, it is better if the Government facilitating agricultural input supply for the farmers and giving awareness as they adapt using this inputs in modern ways to increasing their annual income.
6) An increase in the household age discouraged adoption of wheat row sowing. Young household heads are more interested in involving in new agricultural technologies because of their risk taking character is higher than old household heads that are risk averse. So it is better to encouraging young people as they actively participate in wheat row sowing by Woreda agricultural sectors to improve their annual income.
7) Availability of labour force used was found to be positively and significantly influencing farmer's wheat row sowing. The low productivity of crop may strongly associate with the lack of availability of labour forces and other factors. Hence, farmers require immediate intervention and support. Therefore, it is better to providing the adaptation of wheat row sowing by using modern technology to minimizing traditional labour force in the study area.

Hence, expansion in the level of technology adoption would consequently result in substantial agricultural productivity and output on a sustainable basis. Generally, wheat row sowing has a potential to increase farmers farm income. As such, the smallholder farmers should be encouraged to adopt wheat row sowing technology so as to increase their farm income and improve their livelihood.

References

[1] Abebe and Workayehu, (2015) plant growth regulators were used Row sowing of wheat, rather than broadcasting method, improves production and productivity

[2] Alston and Pardey (2014), In sub-Saharan Africa (SSA), productivity levels are low and growth rates have recently stagnated and World Bank, (2008).

[3] Ehui and Pender (2005); Diao et al. (2008); Barrett et al. (2010); World Bank (2008); Kijima et al. (2011). underdeveloped agricultural research and extension systems.

[4] Gollin et al. (2005); Doss2006; Lee et al. 2005; Erenstein et al. 2008). looking for other approaches to address low agricultural productivity in SSA

[5] Vander casteelen et al., (2016). farmers grow wheat and it is the dominant cereal crop in over 30 of the 83 high-potential agricultural

[6] Geremew et al., (2016). the latest farming technology aggressively promoted for adoption by smallholder farmers in Ethiopia

[7] Kassa (2003); Tadesse and Kassa, 2004. In some cases, giving up or reducing the use of technologies has been reported

[8] ATA, (2013b). As a result, average grain income increased from 12.6 to about 21 quintals/hektar or by 70%.

[9] Behailu, (2014). Income of row sowing method reached about 24 quintals/hektar and the net revenue will 20% larger than the traditional broadcasting method

[10] Ilahi (2000); Doss 2001; Lee (2005). This study expands what limit evidence there is on how new technologies affect labor usage.

[11] Doss (2006). under which the profitability of a new technology can be assessed

[12] BoARD, (2011). Uncovered seeds are also prone to erosion (water and wind) and bird attack

[13] Minjara Wored. Yonas, B. and Behailu (2014) examine determinants of the adoption of row sowing on Wheat crop sowing farmer's and improvement on the production of Wheat crop sowing].

[14] Mesafint, (2017) Determinants of adoption of Wheat crop sowing (Eragrostis tef) row sowing technology in Moretna Jiru Woreda, North Shoa Zone of Amhara Regional State

[15] Mekidelawit Ayal (2018) Determinants And Intensity Of Adoption Of Wheat crop sowing In Minjar Shenkora Woreda,

[16] Begashaw, M. (2018). The Impact of row sowing of Wheat crop on rural farmer income: A case of Tahtay Maychew Woreda, Tigray

[17] Berhe et al. (2011); Bekabil et al., (2011); ATA, (2013) the amount of production is not as much as its area coverage and value.

[18] ATA (2012a), Crop grain plant with space' commence with growing seedlings in a nursery school and sowing.

[19] Tolesa. (2014), Conducted a study on the Socio-economic and Institutional Factors Limiting.

[20] ATA, (2013a). As the Results of 2012 improved wheat Technologies Demonstration Trials Draft Report at Addis Ababa, Ethiopia.

[21] Tsegaye and Bekele (2012) investigated impacts of adoption of improved wheat technologies on house hold's food consumption in south eastern Ethiopia.

[22] Gashaw et al. (2014) marketing assistance as full-package obtains higher wheat income as compared to non-users.

[23] (Ejegayehu and Berhe, 2016) showed that Effect of wheat row sowing technology adoption on small farms income in Ofla Woreda, Ethiopia by using propensity score matching method

[24] Dasgupta (1989) indicate that, the decision to adopt an innovation is not normally a single instantaneous act, it involves as a process.

[25] Tulema et al. (2008); Fufa et al. (2011) land is repeatedly ploughed before sowing to prepare the seedbed and control weeds, but this leads to increased erosion and. lower soil fertility

[26] Tsegaye & Bekele (2012) investigated impacts of improved wheat technologies on house hold's food consumption in south eastern Ethiopia.

[27] Gashawetal., (2014); Sarah, 2014) wheat farmers in locate in four main wheat belt regions of Ethiopia: Amhara, Oromia, SNNPR, and Tigray

[28] Ray (2001), Adoption does not inevitably follow the optional stages from consciousness to adoption; trial may not be always practiced by farmers to adopt new technology.

[29] Berhane and Fufa et al. (2011). To improved wheat technologies has received limited international attention mainly because of the crop having only local importance

[30] Legesse, (1998) Adoption of Wheat Row Sowing in Ethiopia, by applying logit model.

[31] ATA Ethiopia (2009). ingredient in Ethiopian diets, but also an integral part of the national culture

[32] Tsegaye and Bekele, (2012); Bolaetal. 2012; and Mamudu et al, 2012). Those results are consistent to the researches that had been done before

[33] Ibid, (2010), The beneficiary tries to segregate the "cause" (independent variables) and scan whether it has any possessions on reliant variable wheat row sowing adoption.

[34] IDRC (2003), According to this type of research design is use in descriptive research design and in determination of relationship of variables.

[35] Ghauri & Grønhaug, (2010). Research design was use because of the limited time and finance in field work and the fact that it was deemed to be adequate for addressing the study objectives

[36] Ejegayehu and Berhe, (2016) the conditions of areas where the technology is to be introduced showed that Effect of wheat row sowing technology adoption on small farms yield in Ethiopia

[37] Watson Jeff, (2001) provides a simplify formula to calculate sample sizes.

[38] Dawson, (2009). The accurate sample size in a study is reliant on the nature of the population and the function of the study

[39] Babbie (2003), the most effective evaluation research is the one that combines qualitative and quantitative components.

[40] Imbens (2000) and Lechner (2001) when leaving the binary treatment case the choice of multinomial logit is quite easier to analyze dichotomous variables

[41] Assefa and Gezehegn, (2010) young farmers are more likely to adopt new technologies, because they may have more schooling than older farmers and have been exposed to new ideas and hence more risk takers.

[42] Afework and Lemma, (2015), Sisay, (2016), Hassen et al, (2012) educational level of the household head has a positive effect on the status, intensity and speed of technology adoption

[43] Aman and Tewdros, (2016) indicated that farm experience affect improved agricultural inputs

[44] Almaz, (2008) Participation indifferent meetings and consequently have greater access to information.

[45] Akpan et al, (2012) Income earning farm households are able to overcome the financial constraint with respect to technology adoption and purchase

[46] Tiamiyu et al, (2014);-The credit availability positively affects the adoption of improved technologies.

[47] Wuletaw and Daniel, (2015; Hadush, (2015). Farmers who participated on training, their probability of adopter and nan-adoption of new technologies increase.

[48] Leuven and Sianesi (2003). The model is estimated with STATA software using the propensity score-matching algorithm developed.

[49] Wang, P, (2013), Tilt and Gerkey (2016) Relocated people suffer from the loss of farmland, forestland, houses and other properties, which may then reduce their income.

[50] McDonald et al. (2018) found impact wheat row could have positive impacts on maintaining and raising the income level of the farmer's community.

[51] Galipeau et al. (2013) compared the distinction between a adapter community and a non-adapter community in term of income and number of livestock

[52] Rosenbuan, (2002);-If there are unobserved variables that affect assignment in to treatment and the outcome variable simultaneously a hidden bias might arise to which matching estimators are not robust

[53] Hadush (2015) and Wuletaw and Daniel (2015) training affect use of wheat row sowing adoption.

[54] Sall et al., (2002; Shiyani et al., (2002); Wabbi et al., (2006) the intensity or magnitude use of that technology, given that adoption has taken place.

[55] Hassen, (2014), Empirical results revealed that frequency of contacts with extension agents has an influence on adoption of new technology.